

In April 1994, the property was sold to Azure, Inc., a development company from Phoenix, Arizona, who is looking into real estate development possibilities. Azure, Inc. has retained Walsh and Associates as a consultant (Theile 1994).

It has been reported that a large amount of tailings have been moved from tailings piles to the town of Rico for use as gravel road cover. The amount of tailings moved and the years this operation has been used are both unknown at this point (EPA 1994).

3.4 SITE GEOLOGY

Detailed information about the geology of the R-A site area can be found in "Geology of the Rico Mountains, Colorado" by Whitman Cross and Arthur Coe Spencer (USGS 1900); "Geologic Atlas of the United States, Rico Folio" by Whitman Cross and F. L. Ransome (USGS 1905) and "Geology and Ore Deposits of the Rico District, Colorado" by Edwin T. McKnight (USGS 1974).

The geology of the Rico Mountains is extremely complex with the dominant structure of the district a faulted dome centered near a monzonite stock. A central faulted horst block of Precambrian rock has been uplifted about 6,000 feet. The lower slopes of the Rico district are generally covered by debris from the hillsides from wash, talus and landslide processes (State of Colorado, Geological Survey (CGS) 1975; USGS 1900; USGS 1905; USGS 1974).

Bedrock in the district ranges from Precambrian to Permian. Precambrian rocks include older greenstone and metadiorite and later Uncompaghre Quartzite which is at least 1,000 feet thick. Overlying the Precambrian is Devonian age Ouray Limestone succeeded by Mississippian Leadville Limestone with a combined thickness of approximately 169 feet. Both formations have been metamorphosed by the monzonite intrusive body. Approximately 2,800 feet of Hermosa Formation (Middle Pennsylvanian age) is the next youngest strata. The Hermosa Formation is of great economic interest because most of the ore deposits of the district occur in it, particularly in its limestone beds. The Hermosa is overlain by the Rico Formation (300 feet thick) of Middle and Late Pennsylvanian age. The highest formation exposed in the district is the Cutler Formation of Early Permian age with at least 2,800 feet of strata remaining (USGS 1900; USGS 1905; USGS 1974).

At the end of the Mesozoic Era, the sedimentary sequence was intruded by sills and dikes of hornblende porphyry. At a later stage, the sequence was intruded by a less silicic stock of monzonite. Channelized metamorphism may extend up to 1.7 miles from the stock (USGS 1974).

The ore deposits of the district consist of (USGS 1905; USGS 1974):

- Massive sulfide replacement deposits in the limestones of the Hermosa Formation;
- Contact metamorphic deposits of sulfides and iron oxides in limestones of Ouray, Leadville and Hermosa Formations;
- Veins on fractures and small faults in Hermosa sandstones and arkoses; and
- Replacement deposits in residual debris in lower the Hermosa Formation (the rich blanket deposits).

3.5 SITE HYDROGEOLOGY

No hydrogeologic studies of this area were located during this investigation; thus, the following discussion is based on assumptions from available geologic studies. The principal aquifer in the R-A site area is the shallow alluvial aquifer.

As stated in Section 3.4, Site Geology, the valley sides and bottom are thickly covered by detritus from weathering and erosion. This material forms a shallow unconfined aquifer through which the streams and rivers of the region flow. Hydraulic conductivity is assumed to be fairly high (10^{-2} centimeters per second (cm/s)) (Office of the Federal Register 1990). The direction of shallow groundwater flow is estimated to be south along the Dolores River and southwest along Silver Creek (EPA 1994b). Some local areas, such as near tailings piles, may seal themselves through the sifting of fine-grained material (BOR 1994). The shallow aquifer is heavily mineralized in most cases. The State of Colorado, Division of Highways, drilled a well on the south end of the

town of Rico for water supply for a maintenance shop but had to abandon it after a couple of years due to heavy mineralization in the pipes (State of Colorado, Department of Transportation (CDOT) 1994; State of Colorado, Office of the State Engineer (CSE) 1994).

Deeper bedrock aquifers exist in the various limestone strata in the older formations and in the fractures in the formations. Several of the old exploratory drill holes on the Dolores River portion of the site, flowed water and had to be capped (AMC 1988; AMC 1994). Groundwater reaches the surface in the form of several seeps and springs found in the area and a number of these appear to be geothermal in nature. One drill hole is used by locals to supply hot water to a pool the locals use to soak in (Jahnke 1994). Many of the springs contain carbonic acid gas and sulphureted hydrogen (USGS 1905), some springs are calcareous due to the high carbonate of lime contained by many of the geologic formations and several springs are iron-bearing and have left local deposits of iron oxide (USGS 1900). In the vicinity of the R-A couple, deep groundwater has been allowed to flood the abandoned workings and is discharged through the St. Louis Tunnel Adit to a small treatment system (EPA 1984b; WMD 1994).

3.6 SITE HYDROLOGY

The Dolores River and its Silver Creek tributary are the major surface water bodies in the R-A site area. The Dolores River flows to the south past the St. Louis Tunnel Adit, the old sulfuric acid plant, the cyanide heap leach basins, and numerous tailings piles and settling ponds (USGS 1960). Silver Creek flows to the southwest and is the source of the town of Rico's drinking water. Below the drinking water diversion, Silver Creek flows past several mine workings including the Blaine Tunnel and the Rico-Argentine Mill and settling ponds. Silver Creek flows through the town of Rico before joining the Dolores River on the western edge of Rico. The only flow rate data is from a gage on the Dolores River at a point four miles below Rico. At this station the 41-year annual mean flow rate is 136 cubic feet per second (cfs) and the upstream drainage basin encompasses 105 square miles (mi²) (USGS 1993). The Dolores River is not used as a source of municipal drinking water; however, there are twelve listed diversions within fifteen downstream miles of the R-A site. The St. Louis Tunnel is the only diversion

with domestic use listed, as well as industrial and stockwatering; however, it is doubtful that any domestic use actually occurs from this water source. The other surface water diversions are used for irrigation, stockwatering, industrial, recreation, fire and other purposes (CSE 1994).

3.7 SITE METEOROLOGY

The R-A site is located in a semiarid climate zone. The mean annual precipitation, as totaled from the University of Delaware (UD) database, is 12.8 inches. The net annual precipitation as calculated from precipitation and evapotranspiration data obtained from the UD is 4.1 inches (University of Delaware (UD) 1986). The 2-year, 24-hour rainfall event for the site is approximately 1.5 inches (Dunne and Leopold 1978).

4.0 PRELIMINARY PATHWAY ANALYSIS

This following analysis will consider potential site impacts on the air pathway, groundwater pathway, surface water pathway, and soil exposure pathway utilizing HRS guidelines (Office of the Federal Register 1990).

4.1 SITE SOURCE QUANTITY AND CHARACTERISTICS

Source areas at the R-A site include the estimated 75 acres of tailings piles and settling ponds along both the Dolores River and Silver Creek (EPA 1984b). The St. Louis Tunnel discharge of 1.1 to 1.5 MGD is also considered a R-A source (WMD 1994).

and an unknown amount of tailings moved into the town of Rico as street cover. This material has been removed from mining operations near Rico and has reportedly caused dying yards in Rico. (EPA 1993)

and tailings moved to town.

The source areas are estimated to contain 400,000 tons of material at the R-A site (EPA 1984b). A number of sampling efforts have been conducted at the site. These include an ACC contractor from 1980 through 1983, EPA-sponsored sampling in 1984 and BOR sampling from 1989 through 1993. These sampling efforts focused on surface water and sediment analyses (EPA 1984b; E&E 1985; BOR 1994). No characterization of the tailings piles, tailings ponds or settling ponds has been located in the file search; however, review of geologic studies, mining texts and personal conversations with employees of the old mining companies, leads to an assumption that cyanide and the heavy metals

typically associated with sulfide ores would be the contaminants of concern in the source areas. No mention of the use or storage of any other hazardous wastes was found in the files.

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Approximately 92 people live in the town of Rico and 123 residents are listed in the U.S. Census Bureau's Rico division which is within the four-mile target distance limit (U.S. Department of Commerce (USDOC), Bureau of the Census 1990). The Rico area is experiencing recent population growth due to growth and overcrowding in Telluride. Due to the tailings that have been moved into Rico, it is assumed that all 92

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residents of Rico live on a source area. From U.S. Geological Survey topographic maps, the portion of Rico that appears to still have houses covers approximately two square miles equal to 1280 acres. It has been reported that ~~Ames~~ ACC owned 2500 acres in the Rico area; from this it is assumed that all 123 residents of the Rico division live on a source area.

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Bald Eagle (*Haliaeetus leucocephalus*),

Mexican spotted owl (*Strix occidentalis lucida*)

Department of the Interior, Fish and Wildlife Service (FWS) 1994). Federal

candidate species North American wolverine (*Gulo gulo luscus*) and Northern

goshawk (*Accipiter gentilis*) may also inhabit the Rico area (FWS 1994).

No National Wetland Inventory maps have yet been prepared for this area (Earth

Science Information Center (ESIC) 1994). The EPA's 1984 sampling effort did not

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It has been suggested that tailings have been moved to town.

Southwestern willow flycatcher (*Empidonax traillii* extimus) (proposed endangered), and black-footed ferret (*Mustela nigripes*) (endangered)

Black Tern (*Chlidonias niger*), Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), Round tail chub (*Gila robusta*), and Flannelmouth sucker (*Catostomus latipinnis*).

typically associated with sulfide ores would be the contaminants of concern in the source areas. No mention of the use or storage of any other hazardous wastes was found in the files.

From reports in EPA, CDH and BOR files, it is assumed that all tailings piles, tailings ponds and settling ponds were constructed with native material without liners or runoff/runoff controls. The two cyanide heap leach pads that were built did incorporate Hypalon liners and overflow berms but these have not been maintained to the present time (BOM 1974; DOM 1975b, WMD 1994).

4.2 AIR PATHWAY

4.2.1 Source Area Data Gaps

No source characterization sampling has been conducted at the R-A site. No ambient air monitoring has been performed at the R-A site. The air pathway was evaluated on the potential to release.

4.2.1 Target Populations

Approximately 92 people live in the town of Rico and 123 residents are listed in the U.S. Census Bureau's Rico division which is within the four-mile target distance limit (U.S. Department of Commerce (USDOC), Bureau of the Census 1990). ^{recent} The Rico area is experiencing ^{over} growth ^{and crowding in} due to ^{Telluride} recent growth. No other residents were located. The nearest residents appear to be approximately six-tenths of a mile upgradient from the St. Louis Tunnel (USGS 1960). It is estimated that eight people reside between one-half and one mile from site sources and an additional 76 between one-half mile and one mile (USDOC 1990; USGS 1960). The federally listed threatened and endangered ^(endangered) Bald Eagle (*Haliaeetus leucocephalus*), ^(threatened) Peregrine falcon (*Falco peregrinus*), and Mexican spotted owl (*Strix occidentalis lucida*) potentially inhabit the area (U.S. Department of the Interior, Fish and Wildlife Service (FWS) 1994). Federal candidate ^(Category 2) species North American wolverine (*Gulo gulo luscus*) and Northern goshawk (*Accipiter gentilis*) may also inhabit the Rico area (FWS 1994).

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^{(Gila robusta), and} Black Tern (*Chlidonias niger*), Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), Round tail chub (*Gila robusta*), and Flannelmouth sucker (*Catostomus latipinnis*).

It has been suggested that tailings have been moved to town.

report? ident. f.g?
or critical habitat
~~find~~ wetlands within one mile of the site (EPA 1984b); however, it is reasonable to assume that forested and emergent wetland vegetation exists within the specified four-mile target distance limit. A significant community of montane riparian forest (*Populus augustifolia*-*Picea pungens*/*Alnus incana*) can be found on the east bank of the Dolores River within four miles of the site. This natural community is ranked rare to uncommon both globally and in Colorado (Colorado Natural Heritage Program (CNHP) 1994).

4.2.2 Air Pathway Specific Data Gaps

additional After performing an analysis of all potential sources on site, URS was ~~not~~ *skt* able to identify ~~the following~~ areas where additional data acquisition is required:

Source characterization sampling has not been conducted.

4.3 GROUNDWATER PATHWAY

The groundwater pathway was evaluated on the potential to release. No groundwater monitoring data is available. The CPDES permit monitoring does show a release of silver, lead and zinc from groundwater drainage discharging from the St. Louis Tunnel (WMD 1994).

4.3.1 Target Populations

The population potentially impacted by groundwater contamination consists of the users of three wells listed as household use by the Colorado State Engineer (CSE 1994). Two of these wells are located approximately one-half mile upgradient of the St. Louis Tunnel Adit and its associated sources on the Dolores River. According to the owner of one of these wells, no water quality problems have been encountered since drilling the well for a drinking water source in 1990 (Jahnke 1990). The state engineer lists the well depth as 160 feet; however, the owner was unsure what depth the screened interval was placed (CSE 1994; Jahnke 1994). The third domestic well is at the south end of the town of Rico, approximately one and one-half miles downgradient of the source areas and below the confluence of Silver Creek and the Dolores River (CSE 1994; *+*)

USGS 1960).

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SURFACE WATER PATHWAY

The surface water pathway was evaluated on observed release by chemical analysis.

4.4.1 Drinking Water Threat

The drinking water threat is used to evaluate the threat associated with the actual or potential release of hazardous substances from a site to drinking water resources. There are no municipal drinking water diversions within fifteen downstream miles from the R-A site on the State Engineer's Water Rights Report. There are twelve total diversions on the Dolores River, one of which

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USGS 1960). Approximately six people use these wells, possibly for drinking water (Jahnke 1994; USDOC 1990).

4.3.2 Wellhead Protection Area

The R-A site does not lie within a state or federally designated wellhead protection area (State of Colorado, Department of Health, Water Quality Control Division (WQCD) 1994).

4.3.2.1 Resource Use

Groundwater within the specified four-mile target distance limit is limited to the three household wells discussed in Section 4.3.1 and one industrial use well owned by the Rico Development Corporation (CSE 1994).

4.3.3 Groundwater Pathway Specific Data Gaps

After performing an analysis of all potential site-related sources and associated receptor targets, URS has been unable to identify ^{the following} areas where additional data acquisition is required:

Water quality analyses of the three domestic wells, particularly the single downgradient well.

4.4 SURFACE WATER PATHWAY

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usually
you've presented no chemical analysis here; mention substances, ref. back to earlier section.
A permit violation does not equal a LI/LII target, only a release by direct observation.

includes domestic use in its multiple use codes. This water right is listed as the St. Louis Tunnel and includes industrial and stockwatering as its other uses (CSE 1994).

The town of Rico obtains its drinking water from a diversion on Silver Creek ^{potential} ~~well~~ above the ^{from R.A. mining operations (Figure 2).} ~~mining~~ impacts. The water is treated through infiltration galleries and chlorinated (E&E 1984c).

4.4.2 Human Food Chain Threat

The human food chain threat is used to evaluate the threat associated with the actual or potential release of hazardous substances to surface water containing human food chain organisms. ACC contractors found decreased aquatic life in the Dolores River in the 1980s, but could not attribute it to the site (EPA 1984b). A number of federally listed threatened and endangered fish may utilize the surface water habitat as discussed in the next section under Environmental Threat. ~~The presence of harvestable sizes of game fish has not been confirmed.~~

The State of Colorado, Division of Wildlife (CDOW) conducted fish studies on two 500 foot reaches of the Dolores River near Spruce Creek, one and one-half miles below Rico, in 1982 and found three rainbow trout between ten and twelve inches in length and one small brown trout. The CDOW performed habitat improvement in the form of instream boulders and check dams which led to increased populations of brown trout between five and six inches in length in 1983. By 1984, CDOW fish sampling showed greatly increased populations of ten to twelve inch brown trout and slightly increased populations of rainbow and brook trout (State of Colorado, Division of Wildlife (CDOW) 1994). Local bait and tackle shops confirmed the presence of harvestable game fish in the upper reaches of the Dolores River (Duranglers 1994).

The Dolores River above Rico experiences heavy fishing pressure and CDOW stocks fish in the River through the town of Rico. The upper head-waters of the Dolores River support a viable native cutthroat trout fishery. Silver Creek has little aquatic life because of the heavily mineralized water below the mines; however CDOW has stocked native cutthroat trout approximately two miles above Rico in Silver Creek and they are doing relatively well (CDOW 1994b).

4.4.3 Environmental Threat

The environmental threat is used to evaluate the threat associated with the actual or potential release of hazardous substances from a site to sensitive

environments specified by state and federal statutes. While no National Wetland Inventory maps are available for the upper Dolores River area, it may be assumed that a limited amount of emergent vegetation exists within the specified fifteen-mile downstream target distance limit. The 1984 EPA sampling effort did not ~~locate existing~~ ^{identify or critical habitats} wetlands within one mile of the site (EPA 1984b). A significant montane riparian forest can be found on the east bank of the Dolores River within four downstream miles of the site area (refer to Section 4.2.1 for more discussion). Another montane riparian forest community (Populus augustifolia/Cornus sericea) occurs along the Dolores River approximately fifteen miles downstream from the R-A site. This natural community is ranked very rare globally and in Colorado (CNHP 1994).

Federally listed threatened and endangered aquatic species that potentially use the Dolores River include the Colorado squawfish (Ptychocheilus), the Humpback chub (Gila cypha), the Bonytail chub (Gila elegans) and the Razorback sucker (Xyrauchen texanus). Federal candidate species include the Flannelmouth sucker (Catostomus latipinnis), and the Roundtail chub (Gila robusta) (FWS 1994), ^{or} and the Colorado River cutthroat trout (Oncorhynchus clarki pleuriticus), FWS 1994b.

4.4.4 Surface Water Pathway Specific Data Gaps

After performing an analysis of all potential site-related sources and associated receptor targets, URS identified the following data gaps with regard to the surface water pathway:

- move to source section.*
- ~~No source characterization sampling has been conducted at the R-A site;~~
 - ~~Confirmation of harvestable quantities of fish ^{whether any} being collected from the Dolores River; and ^{any exists in}~~
 - Determination of ~~existence of~~ ^{are present} impacted wetlands ^{of whether proximal} on the Dolores River.

① Do any previous data qualify for rulemaking?
Maybe we need to sample. → BOR data & E&E data may qualify

② Confirm T&E species.

4.5 SOIL EXPOSURE PATHWAY

The soil exposure pathway was evaluated ~~on the potential to release~~. No soil sampling has been conducted at the R-A site.

based on the containment of on-site sources, and the presence of observed contamination to both on- and off-site soils.

"release" is wrong jargon for this pathway.

4.5.1 Target Populations

4.5.1.1 Resident Populations

There are no known residents living on the R-A site or within 200 feet of source areas at the R-A site (USGS 1960). The site is inactive; therefore, no workers are on-site.

Follow-up on the allegation that

4.5.1.2 Nearby Populations

tails have been moved to town + there are hot spots.

123 people reside on, or live within 200 feet of, contaminated soil areas

Based on census data for the town of Rico, the Rico division and Dolores County, approximately 84 people live within one mile of the R-A site (USDOC 1990; USGS 1960). There are no restrictions to access of source materials on the site. Access roads lead to mine adits, mills, tailings and ponds with no gates or fencing (EPA 1984b). The R-A site is in a National Forest with high recreational use.

Its on Fed. land on on land patented by Nat'l Forest?

4.5.1.3 Terrestrial Sensitive Environments

The endangered Black-footed ferret (~~Mustela nigripes~~) and Bald eagle (~~Haliaeetus leucocephalus~~) may utilize the R-A area. The proposed endangered southwestern willow flycatcher (~~Empidonax traillii eximius~~) and threatened Mexican spotted owl (~~Nyctalex~~) may utilize the site area as habitat (FWS 1994). Several montane riparian sensitive communities are also found in the area (CNHP 1994).

Eagles + Falcons?

Black Tern and Northern goshawk

4.5.2 Soil Exposure Pathway Specific Data Gaps

After evaluating all potential site sources and associated nearby population targets, URS has identified the following data gaps with regard to the soil exposure pathway:

owl (screech owl) also may be found in the Rico area. (FWS 1994a, FWS 1994b)